We thus seem to be warranted in the fourth proposition.

(4) *In five-year groups having each a sunspot minimum year third (or central), there are generally more cool summers than hot.*

From the present point of view, then, it would appear that in our climate sunspot maxima tend to be associated with a preponderance of mild winters and hot summers; and minima with a preponderance of severe winters and cool summers.

The latter condition of things we should now be near; if we suppose a minimum in 1901, then we might expect at least three of the winters, 1899–1903, to be severe, and three of the summers cool, in the sense indicated.

A further feature may here be noticed. If we arrange the summers and winters in vertical series, according as they are in maximum (or minimum years) one year after maximum, two years after, &c., to the extent of five on either side, there are in these vertical series, I find, only two cases of uniformity throughout, viz. these: (1) *All summers of minimum years have been cool;* (2) *all summers in the fifth year after minima* (and therefore near maxima) *have been hot.* This agrees with the foregoing.

A. B. M.

Rotifers in Lake Bassenthwaite.

IF the occurrence of *Asplanchna* as a conspicuous member of the pelagic fauna of lakes has not hitherto been recorded in Britain, it can only be attributed to the lack of attention in this country to the systematic investigation of our fresh-water fauna. On the continent of Europe and in North America, *Asplanchna priodonta* with its variety *helvetica* and other members of the genus are constantly recorded as among the commonest constituents of the lake plankton. I have on several occasions found *A. priodonta* in lochs near Dundee in swarms similar to that described by Prof. Hickson, and I have no reason to suppose that there is anything exceptional in the phenomenon. Mr. John Hood, of this city, a veteran student of the Rotifera, tells me that its occurrence under these conditions has long been familiar to him. He states that the domestic water supply of Dundee, which always contains a variety of pelagic organisms, was on one occasion rendered quite turbid by swarms of the same species.

It must be remembered that Hudson and Gosse's monograph was written at a time when the tow-net had hardly begun to be employed in fresh-water investigation, and that many of the common pelagic species were either unknown, or, like *Notholca longispina* for example, very little known to the authors.

Prof. Hickson does not state whether any males were present in the gatherings obtained by him. It is probable, as Wesenberg-Lund has recently pointed out (*Zool. Anz.*, March 7, that the appearance of any one species in large numbers is an indication of the approach of the "sexual period," which is always preceded by a period of very rapid parthenogenetic reproduction.

W. T. CALMAN.

University College, Dundee, July 5.

THE STORY OF THE SMITHSONIAN INSTITUTION.[1]

IN this sumptuous volume, produced with all that excellence of type, paper, and illustration, in which so many of the American official publications excel, the story is told of how the Smithsonian Institution was founded, and of the work which it has done in its first half-century.

The Smithsonian Institution, like our own Royal Society, has something of a semi-official connection with the Government. Without being a Government department, or deriving its funds from Government, it is in close correspondence with the ruling powers in respect to scientific matters, advises them upon scientific questions, administers funds voted by Congress for specific scientific purposes, and in general keeps an eye upon the scientific side of many national undertakings.

It is presumably in recognition of this semi-official character of the Institution, that the President of the United States has written a brief but interesting preface to the present volume. In this preface Mr. McKinley recalls how, in 1796, George Washington, in his farewell address to his fellow-countrymen, said "Promote, then, as an object of primary importance, institutions for the general diffusion of knowledge, for in proportion as the structure of a government gives force to public opinion, it is essential that public opinion should be enlightened"; and how, thirty years later, "an Englishman, James Smithson, as though influenced by these words, bequeathed the whole of his property to the United States of America in trust 'to found at Washington an establishment for the increase and diffusion of knowledge among men.'"

James Smithson, the benefactor who is thus commemorated, was born in 1765, and was known in his youth as James Lewis Macie, he being in fact an illegitimate son of Hugh Smithson, afterwards Duke of Northumberland, by Elizabeth Macie, a cousin of the Percys, who, at the time of his birth, was a widow.

This fact of his parentage is important, not only as explaining why James Macie subsequently took the name of Smithson, and so gave its name to the Smithsonian Institution, but as explaining also one strong motive which influenced him in founding that institution; for, all his life, it seems, he smarted under a sense of injustice, and was determined that in some way he would attain to fame, though excluded from hereditary rank. "The best blood of England," he once wrote, "flows in my veins; on my father's side I am a Northumberland, on my mother's side I am related to kings, but this avails me not. My name shall live in the memory of man when the titles of the Northumberlands and the Percys are extinct and forgotten."

Smithson was a student of science, and did some sound scientific work. He was a Fellow of the Royal Society, and contributed twenty-seven papers to the *Philosophical Transactions*, the *Annals of Philosophy*, and the *Philosophical Magazine*—papers which, in the opinion of Dr. S. P. Langley, whose biographical sketch of Smithson fronts this history, "give the idea of an assiduous and faithful experimenter." Nevertheless he did not by this path attain any such eminence as would justify him in hoping for the immortality which he coveted, and there can be little doubt that it was at least in part his consciousness of this fact which led him to follow the remaining path to fame, that of a munificent benefactor to the branch of learning which he loved.

In his later years he was a great sufferer. He lived chiefly in Paris, where he cultivated the friendship of Arago. From Arago's "Eulogy on Ampère" Dr. Langley gives a very interesting extract, which is worth quoting in full, as giving us a vivid glimpse of Smithson's declining years, and a rather touching picture of Arago's friendship with him.

"Some years since in Paris I made the acquaintance of a distinguished foreigner of great wealth, but in wretched health, whose life, save a few hours given to repose, was regularly divided between the most interesting scientific researches and gaming. It was a source of great regret to me that this learned experimentalist should devote the half of so valuable a life to a course so little in harmony with an intellect whose wonderful powers called forth the admiration of the world around him. Unfortunately there occurred fluctuations of loss and gain, momentarily balancing each other, which led him to conclude that the advantages enjoyed by the bank were neither so assured nor considerable as to preclude his winning largely through a run of luck. The analytical formulas of probabilities offering a radical means, the only one perhaps, of dissipating this illusion, I proposed, the number of the games and the stakes being given, to determine in advance, in my study, the amount not merely of the loss of a day, nor that of a week, but of each quarter. The calculation was found so regularly to agree with the corresponding diminution of the bank-notes in the foreigner's pocket-book, that a doubt could no longer be entertained."

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[1] "The Smithsonian Institution, 1846–1896. The History of its First Half-Century." Edited by George Brown Goode. (City of Washington, 1897.)

It may be added, by way of sequel, "that Smithson resolved not to absolutely discontinue play (in which he found the only stimulus which could make him forget his physical suffering), but to do so with a care that the expenditure for this purpose was a definite one, and within his means."

Smithson died in Genoa in 1829, having bequeathed all his property to a nephew, Henry James Hungerford by name, and after him to any child of this nephew, "legitimate or illegitimate"; but in case of the said nephew dying and leaving no child, then all the property was, as mentioned above, to go "to the United States of America, to found at Washington, under the name of the Smithsonian Institution, an establishment for the increase and diffusion of knowledge among men."

Henry Hungerford died unmarried and without heirs in 1835, and Smithson's solicitors forthwith communicated with the United States Embassy in London. Then followed discussions in Senate and House of Representatives. Some senators considered that it would be beneath the dignity of the nation to receive benefits from a foreigner. Other senators considered that it would not. The House of Representatives referred the matter to a select committee, and finally the legacy was accepted, and Richard Rush, a lawyer of high standing, at one time United States Minister at the Court of St. James's, was selected to prosecute the claim in Chancery.

When Mr. Rush arrived in London he found that there were eight hundred cases in Chancery ahead of his, yet he managed to get the suit settled in less than two years, a matter "which gave rise to no little surprise," seeing that "the English lawyers themselves admitted that a Chancery suit was a thing which might begin with a man's life, and its termination be his epitaph." It is pleasant to read that this success "was due in a large degree to the extreme friendliness and consideration manifested by the British law officers, from the Attorney-General down." The suit settled, Mr. Rush took passage home in the packet ship *Mediator* with one hundred and five bags, each containing a thousand sovereigns, except one, "which," reported Mr. Rush, "contained 960 sovereigns and eight shillings and sevenpence *wrapped in paper*"—a particularity which is a little comical in face of the fact that the Treasury accounts show that the odd money which he actually paid in was eight shillings and *sixpence*.

And now, of course, the trouble began. Another eight years must pass before Congress could decide what to do with the money. Like our own Royal Society, the Smithsonian Institution had to go through a period of incubation before it could be hatched. Just as Evelyn, Cowley, Petty, and others proposed sundry schemes for giving body to the "Invisible College," so, numerous "persons versed in science and in matters relating to education" gave their views on the shape which the Smithsonian Institution ought to take. Some advocated the establishment of a university, others a central school of natural science; others, again, an institution for researches in physical science in connection with the useful arts. An experimental farm, a school of astronomy, and a meteorological bureau were other proposals; while ex-President Adams urged the establishment of an astronomical observatory "equal to any in the world," an idea for which he fought with great persistence.

At length, in 1846, the existing Naval Observatory having been organised, Mr. Adams was willing to drop his observatory scheme, which had been standing somewhat in the way of a settlement, and in that year the Act incorporating the Smithsonian Institution was passed by Congress.

To John Quincy Adams, "the Smithsonian" owes much. It was mainly by his influence that the bequest was accepted, and, when accepted, that it was resolved to keep the capital intact and spend only the interest. Next to him, the Institution is indebted for its successful foundation to Joel Poinsett of South Carolina. To Poinsett are due the main features of organisation, the plan for a national museum of science and art, and the inauguration of a system of international exchange of books. Other features are due to other men: the establishment of the library to Rufus Choate, of Massachusetts, and George P. Marsh, of Vermont; the establishment of a staff of resident investigators to Richard Rush, of Pennsylvania; and the organisation of the various branches into one whole to Robert Dale Owen, of Indiana.

For the constitution of the Smithsonian Institution we must refer the reader to the volume before us. There he will find it set forth with fulness, and supplemented with a biographical notice of every member of the Board of Regents down to the present time, and with an interesting chapter on the three successive Secretaries, Prof. Joseph Henry, Prof. Spencer Fullerton Baird, and finally Prof. Samuel Pierpoint Langley, who happily is still spared to the scientific world, and at the age of sixty-four shows no abatement in scientific ardour. That the constitution of the Institution was judiciously conceived is sufficiently shown in the brief paragraph with which the late Dr. Goode closes his chapter on "The Board of Regents": "Notwithstanding the fears so generally entertained fifty years ago, the Institution has never, in any respect, fallen under the influence of political interference. No member of its staff has ever been appointed because of the influence of powerful friends or for any reason except that he was believed to be the best man available for the place. No sinecures have been created, and no breath of suspicion has ever tarnished the reputation of any officer or employee."

And now, at the end of its first half-century, what is the scope of this great Institution, and what is the work which it carries on? "To increase and to diffuse knowledge among men," were the aims of the founder, and to these two aims—the *increase*, and the *diffusion* of knowledge—the Institution strictly addresses itself. The Library, the Publications, the Museum, the Bureau of Exchanges, the Bureau of Ethnology, the Astrophysical Observatory, the Zoological Park, and the exploration work of the Institution are some of the main branches of its system bearing upon one or other of these aims.

In most of these branches the Institution is in close alliance with the United States Government. Its library, for instance, is actually beneath the same roof as the library of Congress, and, though kept distinct, forms for practical purposes one library. It is said that the Institution reaps great advantage by this arrangement, inasmuch as it thus has access to a much larger number of volumes, while effecting a considerable saving in its funds. Indeed, it is a question whether a similar amalgamation might not usefully be made between some of our English libraries. Whatever advantages there may be in each scientific society in Burlington House, for instance, having its own library—and some advantages no doubt there are—it is obvious that a certain waste of funds and force results from the Royal, the Geological, the Chemical, the Linnean, and the Royal Astronomical Societies, all situated in the same quadrangle, being possessed of separate libraries, separate staffs of assistants, separate catalogues, and quintuplet sets of many expensive serials and books.

As with the library, so with the museum; the Government and the Institution are mutually benefited by a close alliance. The nucleus of the museum was Smithson's own cabinet of minerals, consisting of some eight or ten thousand specimens. To this were added, in 1858, the collections formed by various exploring expeditions carried out by the United States Government, which till then had been kept in the Patent Office; and in 1861, the collections accumulated by the unfortunate National Institute—a body which was swamped by its own exertions, for its income did not suffice for it to cope with the flood of materials which poured in from all parts of the world in response to its appeals. To this amalgamation of collections was given the name of the United States National Museum, the whole being placed under the care of the Smithsonian Institution, which pursues the enlightened policy of freely distributing duplicate type specimens to scientific institutions, of presenting sets of general duplicates to colleges for educational purposes, and even of lending original undescribed specimens to experienced men of science.

The Bureau of American Ethnology is also a national undertaking, placed under the direction of the Smithsonian Institution. Its germ was an exploration of the cañons of the Colorado, begun in 1867 by Major Powell, which presently grew into a survey, first geographical, then geological, and finally anthropological. In 1871 Congress made an appropriation to be expended under the direction of the Smithsonian Institution for continuing the explorations and surveys, and the organisation became "The United States Geographical and Geological Survey of the Rocky Mountain Region." In 1874 the survey was transferred to the Department of the Interior, and anthropological researches were made more prominent. In 1879 there were four bureaus engaged in surveys in the Western Territories, and these were reorganised in the present Bureau of Ethnology, under the direction of the Smithsonian Institution. Appropriations are annually voted by Congress to enable the Bureau to continue its researches, and publish its results. Its publications, however, are limited to the thoroughly digested scientific conclusions, and only represent a fragment of the enormous amount of work accomplished. What that work amounts to in bulk may be better conceived from the statement that the fireproof vaults of the "Smithsonian" contain MSS. under more than 2000 titles, besides the material for a "Cyclopædia of Indian Tribes" upon 100,000 cards.

Like the Bureau of Ethnology, the National Zoological Park is primarily American. It was commenced, that is, mainly with a view to preserving animals, and especially native animals, which were likely to become extinct. It has not, however, been so generously treated by the nation as some other departments of the Smithsonian work, and, like many things American, the American Zoo fluctuates with American politics. It began well. Dr. Langley had his dream, and a very noble dream it was; namely, to establish a park in which the wild animals might live "as nearly as possible in the conditions natural to them, so that they might breed and thrive in captivity as in their native haunts." An almost perfect spot was found for this purpose in Rock Creek, with flowing water, varied aspects, and differing soils; sunny slopes, cool hillsides, level meadows and rocky cliffs. It was purchased in 1889, and in the following year an Act was passed placing the park under the direction of the Regents of the Smithsonian Institution. The 185 living animals which the Institution already possessed, and which had hitherto been kept huddled together in low sheds and small paddocks, were transferred to the park. All was going well, when, in 1891, "the mutations of politics caused a change in the dominant political party"—then, estimates were reduced, authority to purchase animals was withdrawn, and even the question of abolishing the park was considered. Notwithstanding these difficulties, many successes have been attained, and Secretary Langley lives in hopes of more adequate Government support.

The same "knack of hoping" has to be exercised by Dr. Langley in respect to the Astrophysical Observatory. Unlike the above-mentioned departments, the Smithsonian Observatory has received no aid from Congress. This observatory, in which Dr. Langley has carried on his excellent work under the greatest difficulties, he himself describes as "a one-story building, or rather shed," erected on a site "surrounded by streets and traffic." It was erected in 1890 in the grounds of the Institution, and the expense of its erection and equipment was principally defrayed by a donation of 5000 dollars from Dr. Graham Bell, and a legacy of the same amount left by Dr. Kidder. It is to be hoped that Dr. Langley's ardent desire for a suitable permanent building on a suitable site may soon meet with a response from the nation.

The exploration work of the Institution has been very notable. Nearly every Western expedition, whether Government or private, of any magnitude, has received aid from the Smithsonian Institution. That the Government Surveys in particular, undertaken as they were for definite, practical purposes, should have the scientific eye following them, and usually a scientific corps attached to them, has been of incalculable advantage for the increase of knowledge. First came the surveys for railways and waggon-roads across the public lands of the West. Then the geological surveys of the same region. Then the explorations of the sea coast, rivers, and lakes of the States by the Fish Commission; and investigations of the North American Indians by the Bureau of Ethnology. With all these Government activities the Institution has been, either directly or indirectly, connected. In fine, to quote the words of Mr. F. W. True, who here gives their history, "the Smithsonian Institution has contributed to the work of exploring the domain of nature not only directly by setting on foot expeditions supported from its own funds, and indirectly by aiding and equipping numerous Government and private expeditions, but more remotely as well by influencing independent workers to explore in many lands, and to add new treasures to the national collections."

It is needless in a scientific journal to speak of the importance of the publication work done by the Institution. The "Smithsonian Contributions to Knowledge," and the "Smithsonian Miscellaneous Collections" are too well known to need any detailed notice. A thousand copies are distributed every year to the leading scientific libraries throughout the world. Neither is it necessary to speak in detail of the liberal policy of the "Smithsonian" in its system of international exchanges, a liberality which was furthered by the American Government and met in a like spirit by the British Government, scientific books sent as presents being exempt from duty in both countries. This exchange system, in which until 1862 the Royal Society of London took part as the forwarding agents for Great Britain, has been of immense practical service to the scientific world. Finally, the reader must be referred to the volume under review for the "Appreciations" of the scientific work accomplished by the Smithsonian Institution with which it closes. The appreciations are interesting, but could scarcely be epitomised within the space of a brief article like the present. They are mostly written by well-known scientific men in the United States: "Physics," by President Mendenhall; "Mathematics," by Prof. R. S. Woodward; "Astronomy," by Mr. Holden, Director of the Lick Observatory; "Chemistry" and "Meteorology," by Marcus Benjamin; "Geology" and "Mineralogy," by Prof. Rice; "Palæontology," by Prof. Cope, of the University of Pennsylvania; and so on through the fifteen chapters into which the "Appreciations" are divided.

Prof. Henry, the first of its three famous Secretaries, often used to say "that co-operation, not monopoly, is the watchword of the Smithsonian Institution. Its policy has always been to devote itself to such useful fields of labour as no other institution could be found ready to take up." That policy has been steadily pursued throughout this, its first, half-century of existence, and by the perusal of this volume most readers will be convinced that it has been justified by the results. H. R.

SPIDER AND PITCHER-PLANT.

IN the insectivorous plants of the genus *Nepenthes*, a form represented by a number of species and widely distributed over the Indian and Australian regions, as well as in Madagascar, the pitchers or insect-traps, which are usually regarded as expansions of the leaf-stalk, are suspended, mouth upwards, at the ends of long tendrils proceeding from the tips of the leaves. The gaping orifice, frequently strengthened and kept open by a thickening of the rim, is protected by a lid, which, while preventing the infall of rain, offers no obstruction to the free entrance of insects. To attract the attention of these animals the pitchers are frequently conspicuously coloured in their upper parts, and honey is secreted from glands scattered around the margin of the aperture and on the under-face of the lid. This gaudy and sweetened portion, designed as it is to catch the eye and act as a bait, constitutes the "attractive" area. A short distance within the cavity and below the attractive area just described, the walls of the pitcher are smooth and of a waxy consistency, so that no foothold is afforded to insects, which are consequently precipitated to the bottom of the pitfall if luckless or incautious enough to venture on this "conductive" area. The lower part of the receptacle is filled to a greater or less extent with a fluid containing, amongst other substances, potassium chloride, malic and citric acids, as well as soda lime and magnesia in smaller quantities and an enzyme, which in the presence of the acids has the power of digesting organic matter (S. H. Vines; quoted by "A. W. B.," NATURE, vol. lvii. pp. 367–368, 1898). This fluid, poured out as a secretion from a large number of glands developed in the adjacent walls of the pitcher, is usually crowded with the indigestible remains of insects, commingled with those of which the nutritious tissues are in process of decomposition under the action of the alimentary juice of the plants and of the bacteria which infest it.

The spiders of the family Thomisidæ belong to that artificial section of the order sometimes spoken of comprehensively as the wandering or hunting species as opposed to those of sedentary habit, which spin snares for the capture of prey. Some of the Thomisidæ live on the ground amongst vegetable débris or beneath stones; others on the trunks or leaves of trees; others, again—and these are the species that have attracted the greatest amount of attention—frequent flowers, and lurk amongst the petals on the watch for visiting insects. To this last category belongs the spider (*Misumena nepenthicola*) now under discussion, a species which invariably takes up its abode in the pitcher of a North Bornean (Labuan) *Nepenthes*, perhaps referable to the species described as *N. phyllamphora*.[1] In any case, whatever the name of the plant may be, the *Misumena* appears to inhabit exclusively the one species; for although several other kinds were found growing in the vicinity, they were never observed to be tenanted by spiders.

According to that skilled collector and trustworthy observer, Mr. A. Everett, who kindly furnished me with the notes forming the basis of the account here given, the pitchers in question are somewhat elongate in shape, and constricted a short distance below the rim, broadening out again as the bottom is approached, and narrowing ultimately to a vanishing point where they join the supporting stalk. Just below the upper constriction the spider spins a slight web, adherent to the wall of the pitcher. This web is not of the nature of a snare or net designed to intercept insects, but extends as a thin carpet over a small portion of the conductive area, and enables the spider to maintain a secure hold on its slippery surface. Here it lives and rears its young, no doubt feeding upon the insects which the *Nepenthes* attracts for its own use, capturing them either as they enter the pitcher, or perhaps after they have fallen into the digestive fluid below.

So far as procuring food is concerned, this spider would seem to be no better off than those of its allies which live in flowers and capture the honey-seeking insects that visit them, except in so far as it is not dependent upon seasonal inflorescence for a place wherein to lurk. But in one very important respect it must presumably score heavily in the struggle for existence—that is to say, in its means of escaping from enemies.

It is a well-known fact that almost all spiders, especially those that occur in tropical and subtropical countries, suffer immense mortality from the relentless persecution of the solitary mason wasps, which at their breeding season scour the country and explore every nook and cranny in the eager search for spiders wherewith to lay up a sufficient store of food for the voracious young wasps during the days of their larval existence. From these enemies the flower-frequenting species have no means of escape, except such as is afforded by quiescence in conjunction with the protective nature of their colours, attitudes and form. The slightest movement on their part will attract the notice of the quick-sighted wasp, and bring swift destruction upon them.

Whether or not the mason wasps have the temerity to invade the pitchers of *Nepenthes* in their quest for victims, there is no evidence to show. Possibly long-billed birds thrust their beaks into the insect-trap to extract any living things or organic débris they may contain. At any rate, the account given by Mr. Everett of the behaviour of this spider when threatened with danger, points forcibly to the conclusion that the species is subject to persecution from enemies of some kind or other. This collector found that when an attempt was made to capture them by tearing open the pitcher, the spiders, although very active, never attempted to escape from the mouth of the vessel, but ran down its inner surface, and plunged boldly into the liquid at the bottom, ultimately, if still pursued, retreating to its very base, and burying themselves amongst the remains of ants, moths, beetles, &c., with which the pitcher was more or less choked.

Although many spiders of semi-aquatic habits, such as *Dolomedes*, *Thalassius*, and some species of *Lycosidæ* plunge beneath the surface of water when threatened with danger, and escape along the stems of the subaqueous weeds; and although an example of *Araneus* (*Epeira*) *cornutus*, a terrestrial species which, however, frequents the banks of streams and marshy country, has been noticed, when disturbed, to drop to the ground, run into the water, hide beneath a tuft of weed,[1] and there remain for a minute or so before venturing to climb back to its web, I am not aware that the adoption of water as a city of refuge has ever been recorded of any member of the family Thomisidæ. These spiders, in fact, as already explained, depend for safety upon protective assimilation to their surroundings. Consequently the habit of plunging into the fluid in the pitcher of *Nepenthes*, adopted by *Misumena nepenthicola*, must be regarded, it appears, as a new instinct acquired by the species in connection with the exceptional nature of its habitat; and its behaviour carries with it the conviction that the species is constantly subject to persecution from some enemy other than man, whether it be bird or wasp.

Possibly the spiders, when once they have taken up

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[1] I am indebted to my colleague, Mr. A. B. Rendle, for kindly examining the two fragments of the pitcher sent home with the spiders. Unfortunately the pieces are too small to make the identification of the species other than doubtful.

[1] Prof. Lloyd Morgan, NATURE, vol. xlvii. p. 102, 1893.